HARDINGE

ON THE

Original Formation of Gold,

FROM ITS

Primary Silicious and Sulphurous Oxyds,

AND OTHER

ELEMENTARY SUBSTANCES AND AGENTS,

WITH

Explanations of their Spontaneous Action in Nature's Great Geological Laboratory: First, generating the Precious Metals in a crude Oxydized Metamorphic Condition, chemically combined with other Mineral and Metallic Oxyds.

TOGETHER WITH

The Refining Effects of Status Electricity and Volcanic Action in the Ultimate Production of both Atomic (or Molecular) and **FREE** Pure Metallic Gold.

DESCRIBING

THE ONLY MODE OF PARTING THE GOLD AND SILVER FROM THEIR HERETOFORE DEFIATORY COMBINATIONS BY THE CHEMICAL DECOMPOSITION OF THE ORES, AND SUBSEQUENT SYNTHETICAL GATHERING OF ALL THOSE PRECIOUS METALS.

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Benjamin's HARDINGE

ON THE

ORIGINAL FORMATION OF GOLD,

FROM ITS

PRIMARY ELEMENTARY SUBSTANCES,

SPECIALLY INCLUDING SILICIOUS SULPHIDES; TOGETHER WITH OTHER MINERAL AND METALLIC OXYDS; WITH A DESCRIPTION OF THE PROGRESSIVE CHANGES INDISPENSABLE TO THE FORMATION OF GOLD IN NATURE'S GREAT GEOLOGICAL LABORATORY, AND THE REFINING AGENCIES OF STATUS ELECTRICITY AND FINAL VOLCANIC ACTION IN DEPOSITING NOT ONLY "FREE GOLD," BUT AMORPHOUS, ATOMIC, AND MOLECULAR GOLD

In such a condition, so chemically combined in its heretofore defiatory ores as to be parted only by chemical decomposition of its ores. The following pages will direct the disheartened miner to the saving of *all the Gold*, instead of only that portion of *free* Gold which constitutes but a small portion of the precious metal in most of the quartzose, pyrites, sulphurets, &c., &c.

It is now well known to many intelligent men, both in Europe and America, with whom I have been in correspondence with reference to the subjects contained in the following pages, that I have been for many years ardently and enthusiastically engaged in analytical tests,

as well as synthetical proofs; before I attempted in public lectures, more than five years ago, in this city, to prove the origin of the sixty-five elements of matter composing our globe; how these elements were *progressively* generated, and formed into a gaseous nebula, thence into a semi-fluid, and thence into a semi-solid spheroid. And not only through what laws and agencies the so-called sixty-five elements of matter were generated and formed, but also the *simultaneous* action of the result of those progressively generated laws in producing, *a priori ad posterius*, not only the said sixty-five elements of matter, but also their indefinite combinations for our present analyses: That we may not only know the how, the why, and wherefore the materials of which our globe is composed, not only of inorganic matter, but also of every type and species of organic production, the how and wherefore—and especially of the astonishing connection between the materials composing both organic and inorganic creation. When we shall have learned all these facts, we will have no difficulty in proving our first hypotheses by reversed and alternate reasoning, *a posteriori ad prius.*

This chapter on gold will therefore be better understood by those who have read *with attention* my chapter upon the "FORMATION OF ROCKS." It is known by publications long years ago, that I not only claimed the *aqueous* instead of the *igneous* theory of the first formation of the rocks; but I submitted my reasons for this theory: Not only in the well known spontaneous evidence of the alternate periodical jettings out of some of our globe's safety-valves of torrents of *liquid quartz*, at Iceland (the *Geyser springs*) and elsewhere, also the water found in the middle of quartz crystals—especially in large as well as small *geodes*—being the supernatant water left, after all the crystalline agencies had been absorbed; and this said liquid flint having been thus deprived of the action of its crystalline law, has thus remained in the center of those geodes for many thousands of years; shut up from any possible means of

evaporation through the wall of the quartzose geode. Water has also been recently found in fine molecular divisions in granite by the aid of the microscope.

The recapitulation of these facts at this, to me, late day seems unnecessary to every chemist, who ought to know from his own individual observation that *sulphide of silicium* plays a great part, not only in the formation of rocks and minerals; but in all animally organized beings: And all physicians should immediately understand this. See my chapter upon the anatomical structure, physiological development, &c. Silicates of lime and albumen, nitrous phosphates of ammonia; electrical agencies of vital power in the animal economy, as well as the vast quantity of spontaneous liquor of flint existent all over the world; and taken up into the structures of plants and trees, as well as animals, and spontaneously also in the ocean taken up by the whole family *crustacea;* to be again deposited in vast beds of silicious albuminates; forming banks of coral rocks (so called); carbonate of lime is another formation; as metamorphic changes of rocks of that class prove.

But our immediate subject is the formation and deposit of gold in gold-bearing quartzose rock. The evidence of its primary existence in an amorphous unrecognizable condition (as gold); and how and why it, like all the baser metals in this particular, is a chemical result of long ages of changing combinations from the first generated gases into semi-fluids, thence into semi-solids, thence by other rapidly accumulating agencies into such vast deposits of the latent combustive materials described in my lengthy chapter upon the *Original Formation of the Rocks, Minerals*, &c.; and the great variety of geological developments by volcanic action, and the metamorphic changes *ad interim;* and the second volcanic period which deposited gold in the various conditions, both *free* and in chemical combinations *aforesaid*—the latter conditions requiring the means of chemical decomposition, gathering, parting, &c. When we look into and shall have satisfied ourselves with reference to the causes and

results of our conclusions; aided as we all are by very many incentives to the proofs as to cause and effect; we can easily account for all those heretofore unexplained phenomena; as also how the gold-bearing seams (or lodes) became so formed in diagonal or transverse directions through the quartzose dykes, during their evident windings, seethings, surgings, and contortions, when in a liquid state; in which condition, laminar or homogeneous, the *seams* aforesaid are evidently the filling in of cracks or fissures caused by cooling and shrinkage, where these fillings are upheavals from the still liquid compound far down toward the center of the globe's vast cauldron: And crystallization was aided in these, as well as in the quartzose dykes, by heat.

It is known to many, that about four-fifths of all the rocky portion of our globe are quartzose sulphides, deposits; accompanied in most localities with all other mineral oxyds. If we strike a piece of quartz against a steel, the concentrated frictional electricity not only emits fire, but a strong evidence of sulphur is known to be present by the smell. The residuary reddish-yellow powder (often found by the gold-miners) deposited in the fissures and small cavities of gold-bearing quartz, suggested the question to my mind that this was the supernatant sulphide, or sulphurous oxyd of gold, and experiments since have proved it. Fifteen years ago, I was intensely and practically at work in the efforts of synthetically forming solids from their elementary substances artificially prepared by me in this city, corner of Jane and Washington Streets, with a view of dissolving gold-bearing quartzose sulphurets, through the agency of "superheated steam and carbon, together with the introduction of the smallest possible quantity of the cheapest solvent salts." See the wording in my pamphlet, published in October 1856, and four columns and a half from my pen in the N. Y. Tribune, bearing date February 17th, 1857, accompanied with the spontaneous eulogies of distinguished metallurgists upon my

practical productions up to that time. And it is well known to my learned friends, that I have been as ardently, enthusiastically, and practically at work ever since, to the completion and acme of my highest ambition; and upon which the reader will find in other chapters clearly defined and elucidated.

In 1859 I filed in the Patent Office the mode of treating *ten tons* at a time of gold-bearing sulphurets, in manner and construction of furnace and digester different, with the view of making sulphuric acid at the same time, entirely dispensing with the use of a *platina retort.* As my own cold porcelain, when hardened, resists the action of sulphuric acid, and the fact that sulphuric acid is carried to market and kept for any length of time in green glass carboys, suggested the idea last above named. It was at the period last above named that I had become acquainted with, and called into my aid and action, for the several last years, the services of Prof. A. L. Fleury, an educated gentleman and chemist of the University of Munich, in Bavaria. Prof. Fleury has been most of the time domiciliated with me, and constantly engaged, without loss of time, in metallurgic chemistry; and part of the summer months practically engaged in the mines. His printed reports in some of the mining journals indicate and bring to the minds of many scientific men his industrial perseverance, as well as some new discoveries which will be interesting to introduce here, along with other instructive correlative facts pertaining to our subject.

Prof. Fleury, in the introduction to his printed reports, first asks the all-important question, "Why do our chemists find hundreds of dollars of gold per ton in ores which, when worked at the mill, do not pay the expense of mining?

"There is no doubt there have been many swindles perpetrated upon the public, during the last gold mania, but I feel satisfied in my mind that many ores that are now deemed worthless, will enrich some men beyond their own expectations."

It may be well to quote from Prof. Fleury's lecture upon gold before the Historical Society at Boston, Mass., as reported of record and filed in the archives of that distinguished fountain of scientific knowledge, Dr. C. T. Jackson, President; as also before the Polytechnic Association of the Academy of Arts and Sciences at Cooper Institute in this city, which also met a cordial response from all the men of science present on that memorable night of March 12th, 1868.

"All modern accounts agree in tracing the origin of gold to veins of quartzose and schistose character. Wherever gold is found, either in the sand of rivers, or in diluvial deposits, or in rocks, we ever find it enshrined, or, at least, in close proximity to silica, either as quartz or as clay slate, or as another more complex silicious combination. There are some exceptions, however, but these are few in number.

"Gold, in various proportion, is found in most of the metallic sulphurets, arseniurets, and other similar compounds, either combined or free; but these are mostly embedded in quartzose veins, or disseminated in schistose rocks.

"In order to understand more fully why gold is found in the sulphurets and other analogous combinations, and these again are enclosed in quartz veins, we must trace out the *origin of quartz itself.*

"We have here several pieces of quartz; they all contain various metallic sulphurets, and some show traces of free gold, all of which are firmly embedded in the crystalline silicious mass. How did the sulphurets and the gold get into the quartz, and what agency forced the quartz through the fissures of the rocks?

"We all know that quartz is a product of aqueous and not igneous origin. We have ample proofs to that effect in the presence of volatile metals, such as antimony, arsenic, zinc, and others, also in the presence of water in geodes, and the close proximity to hydrated and carbonated minerals. The theory of the injection of

quartz as a glassy, highly-heated mass, by volcanic agency, has been superseded by the more sensible one of aqueous action.

"Reading the clear and beautiful explanation given by Prof. Fremy, in Paris, of the origin of the Geyser springs, and studying over his experiments with bisulphide of carbon on silica, alumina, etc., I could not help coming to the conclusion that *nearly all quartz in nature owes its existence to the decomposition of sulphide of silicium by water.*

"To make this idea clear, I must digress a little, and state my own views on the condition of the interior of our globe.

"Firstly, I believe in the existence of intense heat in the centre of our globe—a heat of such intensity that all the elements are thereby kept in an incandescent gaseous condition.

"Around the gaseous commingled matter I conceive, at first, a very liquid melted mass, attached to a half solid, somewhat plastic crust, which, as it gets farther from the centre, cools, and, in its effort of expanding, breaks into fragments. The crust of our earth (probably forty miles in thickness), I conceive full of crevices and immense caverns, some of which, by passages of various dimensions, communicate with each other, and are ever changing, according to outward radiation of heat, condensation, and cooling of matter.*

"For the sake of illustration, I will call granite a *primary rock*—though I think that many rocks of by far

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* I do not agree with my scientific friend with reference to forty miles' thickness of the earth's crust, or that there is anything like uniformity of thickness, or that all the centre is a molten mass; but that ignition exists wherever fissures admit communication of oxygenated gas from between cavities, and that these cavities are increasing as metallics oxydize and minerals decompose, and will finally deposit and accumulate vast and irresistible accessions to the superabundant latent combustive materials; and that this globe will be destroyed by increased and increasing volcanoes, at no very distant period! See my chapter on "The Formation of the Earth." H——.

greater age than granite exist below, which to *our* surface rocks compare as *our soil does to our own rocks.*

"When granite, or any other compound or simple silicate, is, while under pressure and a bright red heat, exposed to vapors of carbon and sulphur (both of which exist in abundance in the interior of our earth), the silica is decomposed: the oxygen of the silica combines with the carbon and forms carbonic oxyd and carbonic acid, while the sulphur seizes upon the silicium and forms *sulphide of silicium*, a white earthy mass, withstanding a great degree of heat.

"As the interior crust of our earth is continually acted upon by cosmic disturbances, either by the gravitation of our own terrestrial substance, or by solar, lunar, or planetary influences, a gradual or sudden condensation, cooling, and breaking of the harder portions of the rocks takes place; water rushes into the crevices, and, reaching the sulphide of silicium and other sulphides, is instantly decomposed in its turn by the sulphide of silicium into oxygen and hydrogen. Sulphuretted hydrogen gas and a hydrate of silica are formed, both of which are soluble in water, and easily carried along by steam. The upper cavities, mostly filled with water impregnated with carbonic acid, which in itself is a great solvent and combining medium for metallic oxyds, such as Iron, Copper, and others (all of which, no doubt, exist dissolved in this water), are suddenly broken into by these water vapors, carrying the hydrated silica and sulphuretted hydrogen with them, and the oxyds, hydrates, and other metallic solutions are broken up; the sulphur of the sulphuretted hydrogen seizes upon the metals, forms therewith sulphides, and the whole mass is forced upwards, together with the liquid quartz. The hydrated silica, carrying the heavier sulphuretted metals in the centre, comes in contact with the cool atmosphere and the cold sides of the crevices, and a *gelatinization* and gradual crystallization takes place—the sulphurets crystallizing in the quartz.

"I can reproduce, *artificially*, in a small way, what na-

ture has done on a large, gigantic scale: I can heat granite to a white heat, expose it to the vapors of bisulphide of carbon, then treat the sulphides resulting therefrom by steam, and carry the hydrate of silica and sulphuretted hydrogen into a basin containing carbonate of iron or other metallic solution, when the silica will be seen to gelatinize slowly, and the sulphurets of iron or copper crystallize in the silica. After this digression we will return to our chief subject, gold.

"I believe that gold is an *elementary* metallic substance like iron, copper, zinc, etc., and have no faith in the alchemistic idea of commuting baser metals into gold, which idea, from time to time, reappears occasionally among the *savans* on the other side of the water.* (Perhaps no better origin could be ascribed to the element, gold, than that the President ruling the regions below has refined his own favorite beverage, *brimstone*, into gold, and has presented it as a fit material for a golden calf to Moses and Aaron and our anxious bulls and bears of the gold-room.)

"Experiments which I have made in my own laboratory, have led me to the following original ideas:

"1. That gold exists in nature in two distinct *allotropic* conditions: In a *metallic, molecular, crystalline state*, withstanding the action of oxydizing agents under ordinary conditions, and in an *amorphous, non-metallic* and *oxydizable* form. Plumbago and lampblack may illustrate this idea. The former, like metallic gold, is heavy, a good conductor of electricity, and has all the appearance of a metal, while the latter, the lampblack, is easily oxydized, is light, is a non-conductor of electricity, and is amorphous.

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*I do not believe that any or either of the metals or minerals are of themselves "*original elements*," but results of the progressive aggregation generating the first element, then the second, third and fourth; first in a gaseous form, thence into semi-fluid, thence semi-solid, &c., &c. [See my chapter on the "Formation of the Earth."] H——.

"2. That in sulphurets the gold is mostly present in both modifications, and may sometimes be found in a chemically combined state.

"I will here cite a curious experiment, which gives a fair illustration of what I say :

"A quantity of finely pulverized sulphurets from a rich mine in Colorado, Montana, or California, is, at first, carefully treated in a close vessel, with mercury-vapors, then cooled and washed, the mercury separated, and the resulting quantity of gold weighed. The sulphurets, after having been thus treated, are then mixed with fine charcoal dust and plumbago, an equal quantity of each, placed into a carbon crucible, and this into a porcelain retort, which has a tube attached, through which the gases that escape during the heating of the crucible can be passed into a chlorine solution. When the crucible is slowly brought to a red heat, bisulphide of carbon issues forth, and at the same time the chlorine solution darkens ; when tested with sulphate of iron or oxalic acid, a precipitate of gold is obtained. This *volatilized* gold *is not absorbed by* mercury. If the desulphurized remaining ore is then again treated with mercury-vapor, as before, cooled and washed, a third quantity of gold is separated.

"This and a number of other observations, have brought me to think that gold *was*, and still *is*, *existing* in nature in a *chemically combined state, not only with sulphur* but also with *silica* as a *silicate of the oxide of gold* Au O Si O^3, as a *silicide of gold* Au Si, and, perhaps, in many other similar combinations. I ask you simply, my hearers : *Did we ever look for gold in a different state from the metallic?* We speak of invisible gold : we prepare in our laboratories solutions of gold, auric oxides, sulphides, and other combinations, and deny to *nature, which we only imitate*, the right and privilege to have used the same means, simply because our books say otherwise or nothing of it !

"Why can we not *oxydize* gold in its metallic state, *without first dissolving it?* I think it is simply for the reason that it has to be brought to an *atomic, amorphous*

state, and *subdivision*, before it is acted upon by oxygen or sulphur.

"Rose-colored quartz is by miners considered quite a reliable indication that gold may be expected at greater depth. By smelting glass with purple of cassius, oxyd of gold, auric acid, or even finely divided precipitated gold, we produce a splendid crimson glass, which, if a *smaller quantity* is used, has the *color of rose*. If rose-colored quartz is chemically decomposed with fluoride of calcium, gold can easily be detected in the result. I have witnessed many experiments, and made myself, while in Boston, a number of tests with various fluorides, such as cryolite, fluorspar, and the so-called Stevens' flux,—all giving me the evidence that the opinion expressed by Prof. Bischoff, in Bonn, the best authority we have in chemical geology, that gold, as well as platinum, may derive its origin from the decomposition of silicates, is well founded."

Prof. Fleury presented a long catalogue of the combinations of gold chemically prepared in the laboratory, not only the aqueous but the dry way, to illustrate his proofs that all these may be spontaneously produced by nature in the great geological laboratory; and after the exhibit of the auro family relationship, he proceeded to the important point, viz: the *extraction* of gold from its various ores, and adds:

"The experience of the last five years (and a bitter experience indeed it has been for many) has taught us a lesson; namely, not to engage capital in a business before we understand it, practically as well as theoretically, at least in its most important parts.

"The manner in which gold-mining companies have been *raised* (quite an appropriate name for such an operation), during the gold epidemic in this and other cities, is too well known to be here mentioned, and I will only draw a pencil sketch, describing one of the many offices down town, where stock certificates of the many reported flourishing Colorado, Montana, and other gold compa-

nies were sold to the poor pigeons who, attracted by the flattering and glowing report of an *uninterested fashionable friend*, called at one of these praised bowers of wealth.

"Imagine yourself stepping into a large, well-lighted, and splendidly furnished office on Broadway. You see several mahogany desks (such as Presidents only use), with soft cushioned arm-chairs *for confidential chats* placed beside them, and a long table, made of some expensive wood, in the centre, where the daily journals are placed for Mr. *Gentleman Usher* (not of the 'black rod') to hand to the anxious adventurer waiting his turn with the now occupied valuable time of the *ensconsed* Secretary.

"Heaps of glittering and sparkling ores (the so called fool's gold of the miners), sulphurets of iron and copper, are, as if accidentally thrown there, ingeniously arranged so as to give the unsophisticated stranger at once a startling idea of the immense wealth of the company's mines. Several gentlemen, dressed in the height of fashion, mostly headed by a venerable president-looking individual, are seated at their respective desks, the old gentleman occupying another private office in an enclosure. Whenever a stranger enters the office, all is bustle and business. You see enormous ledgers, stock-books, checks, and letters, ready to be handed down at a moment's notice; errand-boys and clerks appear and disappear rapidly (of course some bringing in heavy orders for shares of stock), and the superficial observer is impressed with the extent and importance of the business. The President, after some minutes' delay, admits you to his sanctum, and, with a most winning way and benevolent condescension, explains to you the enormous income that will be made by the Company after all the machines that have been sent out are put to work. Just then the Cashier hurriedly appears, and holding up the bank-book to the President in such an ingenious way as to let you, too, see the large balance in favor of the Company, asks, in audible whisper, of course, if there are any more deposits to be made, the shares of the company being all

sold with the exception of a few odd shares, which, however, have been spoken for by some banking-house, and will be sold next day. Few gentlemen, I believe, left the office without having purchased the *few odd shares* as a great bargain, and after some time they have found, to their great mortification, that the beautifully engraved certificates were the fancy representatives of some "wild-cat" company. Of course the fashionable, uninterested friend, who took you to see the Elephant, gets a good commission, and is ever ready, should you meet him again, to tell you with woful countenance, *that he, too, has lost heavily.*

"Can we wonder, my friends, that our capitalists become shy and adverse to mining enterprises? As one bubble after the other bursts, and the blissful ignorance of the companies becomes known, we cannot blame anybody for holding back and asking for better information.

"When this pernicious, wild, and speculative excitement shall have died away, gold-mining will be carried on as a regular business, depending not from the sale of shares of stock, and the ups and downs of the stock market, but from its own products.

"Knowledge is spreading rapidly. The well-managed Mining School in this city, and other private institutions, will extend beneficial and healthful influences into our mining regions. They well deserve the thanks and encouragement of the nation." *

I will introduce here Prof. Fleury's reports of nearly all the different methods heretofore resorted to, to obtain gold from its ores.

"The various methods of working gold ores can be divided into three classes, the mechanical, the chemical, and the mixed, combining the use of both methods.

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* The General Government has been as derelict in this department as in the protection and development of her other vast resources. [See my chapter upon the portentous financial as well as political condition of the Government, and the immediate correctives which I have submitted as indispensable to its prosperity! H——.

"The *mechanical* method is certainly the simplest, and consists in crushing the ore to powder, by means of stamps or crushing machines, and in extracting the gold by means of amalgamating the precious metal with quicksilver or mercury. The more perfect the crushing and pulverizing process, the better, of course, is also the result obtained by the amalgamation. The crushing of ore is mostly done by the well-known old-fashioned stamp mills. Some use steam or compressed air stamps; some adopt Whelpley and Storer's centrifugal crusher and pulverizer, all of which seem to be improvements on the old stamp mill, and certainly work well where they are in good hands, and connected with machine shops and foundries. A new crusher (Wagner's patent) is now on exhibition in this city, and works as well as any other I have yet seen. The principal feature of this machine is the ingenious manner of crushing the ore *by attrition.* I have seen four hundred pounds of hard quartzose Mexican Silver ore pulverized in eighteen minutes' time to a powder so fine that most could pass through a No. 100 sieve. It weighs about four tons, and is very simple and compact in its construction.

"The old amalgamating system of running the pulverized ore with water over amalgamated copper plates is now gradually giving way to more perfect, though more complicated methods. Some run the ore into variously constructed pans, where, with assistance of heated water, a more perfect mechanical mixture of the ore with the mercury is obtained. This is more especially the case since Professor Henry Wurtz, of this city, has made the interesting discovery that the addition of a small portion of sodium metal to the mercury increases the affinity of the gold for the amalgam; in most cases a considerably increased yield of gold has thereby been obtained. The Freyburgh barrel, as well as Wykoff's process of boiling the ore with salt water and mercury, whereby some of the sulphurets are decomposed, have, when carefully worked, given good results. Another, the "Staats

Amalgamator," treats the pulverized ore in a closed and heated revolving iron boiler, with steam and mercury (in vapor form), whereby also very favorable results are obtained. I beg to mention here my own recently-invented gold extractor, whereby in twenty-four hours ten tons of tailings or pulverized ore can be worked *by one man* at a cost not exceeding *fifty cents* per ton. Prof. Benj'n Hardinge, of No. 20 Waverly Place, New York City, has the sole control of all those patents. [See Records at the Patent Office.] One of these machines (engine and boiler 6 hp. not included) can be made for one thousand dollars. The cost of amalgamating by the most ordinary method is about one dollar per ton.

"My Gold Extractor has one great advantage over others, and this is *that no handling of plates nor separate distillation* is required, the same all being done automatically. The retort is connected with the mercury-bath in such way that the amalgam can be run into the retort and the gold obtained without disturbing the operation by distillation in vacuum. A very efficient chemica agent *assists in decomposing the sulphurets.*

"We will now take up another system of treating the gold ores,—*the chemical method.* We will subdivide it into the wet and dry, or fire treatment. The wet method we will call that by which the gold is extracted from the ore in the form of an aqueous solution, the so-called *chlorine process.* As, however, this treatment requires mostly a previous *roasting* of the ore, we will give at first to this interesting topic some attention.

"We have shown that when sulphurets in powder form are treated with mercury, the gold was very imperfectly amalgamated, and could not all be extracted, only a comparatively small amount of the precious metal uniting with the mercury ; and that a perfect and careful *roasting* of the ore is required, as well as also a condensation of the resulting vapors."

Prof. Fleury had the candor to attribute to me his first recognition of a mode of treating the sulphuretted

ores in the manner described, adding a heartfelt eulogy "upon my industrious habits, extraordinary perseverance, Websterian memory, good humor, and an irresistible habit of illustrating my most abstruse investigations by anecdotes," &c. As a further evidence of my special *weakness* in this particular, the reader is at full liberty to refer to the appendix. I admit that this is my besetting sin, and that I furnished my said protegé with a perfect description of the Gold Quartz Company, Office No. —, in Broadway.

And I can daguerreotype another picture, to which both Prof. F. and myself alluded on said occasion; showing how many capitalists have been duped out of hundreds of thousands by an astute, foxy ignoramus, who copied a few sentences from my pamphlet published in 1856, without altering the wording. He did not know even the meaning of the words he was reading; for he asked what they meant while he was getting a patent agent to attach his affidavit to them as "his first and original invention," &c. He obtained a patent and led many a dupe into a glorious waste of money, during the last nine years;* not only at gold mines but everywhere else where his ignorant, ape-shaped brain has showed itself, with "*forehead villainously low.*" Let those best acquainted look at this (to them) *interesting* picture of a perjured ignoramus; and see if this also is a true likeness. It would be a waste of my valuable time to dwell upon such unfortunate instruments as have too long figured in the (to them) more certain process of "*extracting* gold" from the *pockets* of the less refractory greenhorn-blende lodes, which have been successfully worked by Peter Funks, who have their eagle-roosts in the tops of New York hotels, aided by parasites of the press and gastro-pod go-betweens, as numerous as bed-bugs in this

* All this time I kept on working, and inventing, and superceding studying and working in my laboratory at Woodlawn and elsewhere, and am now presenting results.

great city, and as ready to bite and bleed the unwary sleeper upon his well stuffed pillow of the now portentous and doubtfully destined *legal tenders.*

"What! do you mean to insinuate? &c." Yes; not only insinuate, but state facts, which must present themselves to every reflecting, intelligent man. You may find all the reasons in a chapter upon this important subject (from my pen) elsewhere. Albeit, I am nobody's politician. I have neither time or disposition to take either side, and join in the pernicious waste of time and money in the Don Quixote fight of political windmills, while the only correctives to the salvation of the country, the preservation of this once glorious Union, the perpetuity of *American* free institutions to the future safety of our children, are almost entirely lost sight of! See particulars upon this most important of all subjects at present, under its proper heading, where you will find the only *correctives* humbly submitted to every true intelligent American. But I must first dispose of the present subject, with such digressions (only) as have an illustrative tendency to a plain matter-of-fact elucidation, as well as uncompromising exposé, of our whole subject. And I am bold to further state that our geological, mineral, and metalliferous theories, as heretofore taught and printed "*for the use of schools, colleges, &c.,*" are based upon nonsensical error from the very foundation. And it appears to be high time that these vague, contradictory theories be brought out and exposed to the sunlight searching analyses of scientific investigation; submitting mine, with the "*ipse dixit*" of every other claimant to other opinions, to test them and prove them practically and scientifically, both in analytical and synthetical reasoning from cause to effect, and effect back to cause, submitting clear and unequivocal, practical and incontrovertible evidence. The present has got to become an age of facts, instead of the vague, old-fogy breath of guess-work of the teachings of our old masters or authors, who found it less trouble

to copy than to think for themselves and reason for themselves, and work the number of necessary long years before they can know, of a certainty, not only of the hows, whys, and wherefores — the generated laws and simultaneous action in the first conglomeration and aggregation of the first elements of nature. The origin of all rocks and all minerals: And how

> "With trees, and plants, and flowery birth,
> A naked globe he crowned,
> Ere there was rain to bless the earth,
> Or sun" (did) "warm the ground."

And last, not least (in the estimation of a few), of what materials *we* ourselves are made, and by what laws are kept in motion — subject of thought, sympathy, devotion — some more, some less, some none at all, and say themselves cannot control—and prove it by phrenology. But see chapter on "Man," as a *mentally* as well as *physically organized being*, and what the inspired recorder meant to convey as to his divisions of time—"*yome*" and "*yomim*" in the Hebrew—and how soon, in the same short account, he finds "*good* gold in Havilah."

This, our present subject, is that most attractive and most seductive of all elements, because of its most commanding of all powers that be. Hence the wise man said that GOLD answereth to all things. Albeit among his many admonitions and cautions to the young man, on whom he more emphatically enjoins, among "all his getting, to get understanding," he (Solomon) exhibited in himself a great proclivity for gathering *Gold*. The same kind of "*good gold*" that Moses described to have been found in the land of "*Havilah*," in the same chapter in which he says, "a mist went up from the earth." This was the smoke of Geology's great cauldron, after the general volcanic period which chemically refined and produced nuggets as well as atoms of metallic gold, which Moses says was "*good gold*." And now, as nug-

gets are few and far between, let us see how, in what manner, they were produced, not only in Havilah of Egypt, but in the Havilahs of this great American Paradise, with her almost countless millions of gold and silver—now, not only accessible by the Pacific R. R. and branches, but by improved scientific means of separating these inexhaustible supplies of the precious metals, from their heretofore defiatory hiding-places. But more especially now that, in accordance with the anthem which rises away upon the breeze, in Œolian enchantment, sweeping across the La Platte, and echoing among the Rocky Mountains a response to the earliest sentiment and song which the morning sun of this, then, young and promising republic suggested to the, now,* wounded spirit of the American bard who wrote:

"The morning sun shines from the east,
And spreads his glories to the west;
All nations with his beams are blest
Where'er his radiant light appears.
So Science spreads her lucid ray
O'er lands which long in darkness lay;
She visits fair Columbia,
And sets her sons amongst the stars.
Fair Freedom, her attendant, waits
To bless the portals of her gates;
To crown the young and rising States
In glories of immortal dates."

It appears to have been the order of Providence that the opening out of scientific discoveries, and progress and advancement of the arts, should first take their rise with the eastern sun, and spread with him their glorious luminaries which have lit the ponderous wheels that are now rolling over the Rocky Mountains to the shores of the Pacific, laden with the products of the long and diligent toil of the philosopher, sparkling with

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* I have reference to the present cloud which hangs over the horizon of the political and moral, as well as the general portentous financial destiny of this great Republic.

the diamonds of genius, and spiced with the odors of Parnassus. There are now arising evidences of the most reciprocal responses in California, not only in physical but mental, moral, and political distinction, which will come to the rescue, if the intelligence of the Atlantic States will but rouse themselves to a proper sense of true patriotic duty, and speedily adopt the means of saving their country from pending anarchy and inevitable disintegration. I will cite J. H. Ray, Esq., known to fame in San Francisco, Cal., for the last eighteen years, not only as one of the most enterprising men living, but for his honesty of purpose as well as thoroughness of action. He wrote me that he had proven that "not a tithe of the gold is saved." I hope he will excuse the liberty, but I cite him as an *instaromnium* of very many of our most useful and most promising men in Cal. from the Atlantic States, who will at no distant day come in with money and gigantic intellects to the rescue and perpetuity of the genius, the institutions of their country,* "their home, their native land."

The facilities which the completion of railroad connection between the two oceans will afford, will be inconceivably great for the developments of greater resources than ever belonged to any half a dozen nations of the earth before, especially the production of the precious metals, providing the means be adopted to keep the gold in the country and the ways and means are in manuscript, and will form an interesting chapter to every American who has his country's best interests at heart, and who wishes to preserve and keep alive the genius of the republic, and perpetuate her free institutions to his posterity. More of this anon. But now to the first getting the gold. (Mrs. Glass said, "First catch your rabbit.") And in order to catch our gold, we must

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* Genii of American stamp, sealed with tokens of hereditary crest, and strongly wrought the *die* that does the image bear; who will ever echo back to their Cradle of Liberty and Independence the song of their youth which I have revived on the 19th page to be loudly chanted in the proud Temples of California.

first find out, where that sparsely disseminated article is hidden in its heretofore defiatory matrix; for gold appears to possess an innate, indescribable intelligence, not only after it comes from the mint, and finds cautious way into circulation, playing *hide-and-go-seek* from tin boxes and old stockings into the vaults of the miser, thus acting out the transmitted conceptions of Dame Nature's whole processes down to the full development and parturition of pure virgin gold. But it devolves upon me alone to explain its original capricious changes as to rule of choice in localities, during its chrysauralian changes from its unrecognizable amorphous condition, as well as its determination to refuse the bait of quicksilver, so long as it chemically clings to its sulphuretted quartzose mother. Our business is also, as first above stated, to present the result of the experience of those intelligent prospecters as well as practical workers—those whose reports are based upon comparative induction, after having spent years of trial in many different localities in California, North Carolina, and then a year or two in the more recently discovered gold-bearing quartzose rocks of Nova Scotia. They will tell you of *veins* or *lodes* of gold-bearing quartzose rock of every conceivable variety of combination, besides sulphurets of iron, titanite arsenite, &c., so common to California and North Carolina. They will also tell you of the resistable Wheustone and shistose defiatory ores of all volcanic regions. They will tell you of white quartz veins where the iron has long since oxydized, and renders such veins easily quarried. Why in veins, and why the gold in the veins? (See my pamphlet, "On the Formation of Rocks," and you will be properly guided in your prospecting for gold-bearing quartz.) The object of this chapter is more to show in what condition gold exists in all *those veins* of every name and description—the why and wherefore of those different conditions—the reasons why miners have not been successful in getting a tithe of the gold by the usual processes of working; albeit the chemical tests of the assayist had proven beyond all doubt the exist-

ence of a good paying proportion of gold in the lode which had so disappointed the disheartened worker. The reasons of these disappointments will be fully understood by reading with close attention my work upon the formations of the rocks and minerals, together with the deposits which volcanic action produced, and the metamorphic changes subsequent, by oxydizing and other elements, conducive to the formation of metallic gold, whether free or in combinations aforesaid.

But as the mass of mankind care but little about causes, and a great deal about results, and in a special manner how to get the greatest possible amount of gold in the least possible amount of time, and at the least possible outlay, I will say, Buy of me immediately one-third of all the rights of those recently issued patents in all California, including all the gold-bearing quartzose regions west of the Rocky Mountains, and immediately begin to reap a harvest of inconceivable returns for your investment, not only in the gold direct from its ores, but from the residuary *liquor of flint* as a *base* for an income far greater than that of the gold, when used in the growing city of San Francisco, as well as all the minor towns and cities now springing up in the whole of that rapidly growing country of all countries in the known world.

For the full explanation and proof of the last assertion, you are invited to read the chapter upon moulding white flint marble (appended to this chapter). But before I take up this subject, by far more lucrative than getting out all the gold the rock contains, at even the small outlay which the estimates by those said patents claim. And in order that all interested in gold mining may be fully posted in the comparative as well as relative processes of most of the systems and methods heretofore pursued by practical miners, I will here submit a recapitulation of Prof. A. L. Fleury's collected reports, as above stated. On the twenty-fourth page of his reports Prof. F. says :

"I studied carefully the various processes in use, such as Keith's, Whelpley and Storer's, Dr. Hagan's, Crosby

and Thompson's, Dr. Ott's, Ryason's, and several others, all of which are said to give perfect satisfaction. We will only give to them a rapid glance without comments.

"The furnaces of Messrs. Whelpley and Storer, in Boston, have been described in most of our mining journals; they certainly look as if they could do some good work when properly managed. The ore, finely pulverized in their centrifugal crushing and pulverizing machine, is blown, together with charcoal powder, down a vertical shaft or tower, the gases condensed, and then treated for the different metals. Keith oxydizes the pulverized sulphurets by air in an upward or horizontal direction. Crosby and Thompson do the same in a revolving retort; they condense most of the volatile products. (I learned lately that they get from the condensed smoke as much gold as they extract from the roasted ore.)

"A very neat arrangement for roasting has been patented, and is now being tested in Washington, D. C., by Dr. Adolph Ott, of this city. The sulphurets pass successively through three separate superposed furnaces, in which automatic stirrers keep the ore in motion, and cause it to fall from one oven into the other, receiving three successive treatments, by which the ore is fully decomposed. The lighter metals, zinc, antimony, arsenic, and bismuth, are condensed in separate chambers, and the sulphurous gases subjected to a spray before they are allowed to escape through the chimney. The desulphurized ore is then moistened by steam, and placed into a large tank, where it is treated with *oxychlorine gas*, which rapidly converts the present gold into a soluble salt, the terchloride of gold—Au Cl^3—which is leached out afterwards, either by pressure or by a centrifugal machine. The solution is then treated with sulphate of iron, or other precipitant, and the pure gold taken from it as a dark brown powder. This is quite an improvement on Prof. Plattner's successful chlorination process, and shows that the originator understands what he is about. This process is also adapted for the treatment of silver ores.

"*Dr. Hagan's* desulphurizing process with hydrogen gas and carbonic oxyd and acid, produced by previous decomposition of steam by carbon, is, as I learn, worked quite successfully for two years past in both Grasse Valley, Nevada Co., California, and Plymouth Ledge, in the same State. The *Eureka* or *Ryason* process is also said to work well in the Mariposa State, in California. In this process, I learn, the disintegration, desulphurization, and extraction of gold by amalgam, are all produced by the action of heated steam and mercury vapor on the ore while in a closed vessel, and the tailings run over a peculiarly constructed shacking table, so as to concentrate all the amalgam.

"We will now pass finally to another system, the *smelting method.* When a rich gold ore is heated in a reverberatory or other furnace, and an appropriate material as flux added, the ore melts with it to a *liquid mass*, in which the specifically heavier gold will collect, melt, and sink to the bottom. Soda, lime, oxyds of iron have been extensively used, and some to great advantage. By my experiments with the so-called *Stevens flux*—the residuum from the cryolite when worked for soda—I have been brought to the new idea that gold must exist in nature as a silicate of the oxyd of gold, chemically combined, for, by treating the same ore with other agents (fluxes that do not *fully* decompose silica), I could not obtain the same results.

"This Stevens flux is superior to the natural fluor-spar, because it contains *free* oxyfluorine gas, which has been absorbed by lime in a similar way as chlorine is taken up by it in the bleaching powder, hence its greater efficiency.

"The fluorine has such affinity for the silica that it leaves the calcium, drives off the oxygen, and combines with the silicium to form fluor silicium and fluosilicic acid. The calcium takes up the oxygen, and forms lime.

"I have lately seen some astonishing results produced by the use of this flux with Nova Scotia and Georgian ores.

"Mr. H. G. Hubert, of this city, has recently patented a system of furnaces, in which he uses a mixture of flux and ore as continuous lining of the furnaces (either cupola or reverberatory), with an impervious carbon-bottom. This system cannot fail to come into use when this peculiar method of smelting shall have been better known and appreciated.

"From the foregoing pages you will see that I have taken some pains to keep posted; I may add that during the last three years I have visited many mines, mills, and metallurgic establishments, and have made numerous experiments in my own laboratory. Taking all points, the defects as well as advantages of the aforementioned processes, into consideration, I have followed an entirely distinct road to arrive at long-desired results —the extraction of *all* the gold, with the most advantageous utilization of the refuse.

"By a series of new processes, recently secured by letters patent, I can not only obtain a complete solution of the quartzose ores *in water, but also a complete chemical decomposition of the silica itself*, so as to eliminate *all that gold that has hitherto been lost*, because I believe that it exists in the quartz in chemical combination.

"The best feature, however, and that which distinguishes *this process* from the old quartz-dissolving processes, is that the *hydrate of silica* which I obtain (having no alkali), and which I receive as refuse, can be used for something better than for adulterating soap, and is worth at least *one dollar a gallon*, if sold only for a *fire, water*, and *weather-proof paint*, to say nothing of its use in the manufacture of *cast* (*not compressed*) *flint-marble*, in the shape of statuary, fountains, mantels, tables, monuments, floors, and ornaments of all kinds."

Prof. Fleury closes his lecture in an eulogy upon me, and refers those whose interest he may have awakened to these subjects, to myself, as the only one who is authorized to either sell or work his patents.

It is now my business to describe and fully elucidate both our modes of operating and estimates of same.

COMBINED PROCESSES FOR WORKING GOLD ORES, AND USING THE LIQUID SILICA IN THE ARTS.

The American patents, in which an interest is offered, cover the following operations:

1. Complete desulphurization of pyrites and metallic sulphurets.
2. The extraction of gold and silver from desulphurized ores or tailings by a new system of amalgamation.
3. The solution and chemical decomposition of the quartzose gold ores in the wet way, and without the use of either soda or potassa, by an entirely new process.
4. The utilization of the refuse material for fire-proof porcelain paint, floors, pavements, and all kinds of ornamental stone and marble work.
5. The manufacture of sulphide of silicium and hydrate of silica, with its many uses, either made from sand, silicates, or quartz, and utilizing the sulphur obtained by the desulphurization of the sulphurets.

We will consider the advantages of these processes over all others now in use, and speak:

1. *Of the System of Desulphurization.*—In our combined process we desulphurize the ores in a *complete* manner, because we first bring the ground sulphurets in close and *most intimate contact* with *carbon* and *hydrogen*, whereby the various complex sulphur combinations are broken up *into more simple compounds*, and are, when the ore is treated with alternate *jets of air* and *steam*, made much more ready to give off all the sulphur, while the gold is kept back with the carbon.

2. *The Extraction of Gold by Amalgamation* is performed by passing, by *hydrostatic pressure*, the pulverized

ore* after it has either been treated with chemicals, or been desulphurized, *in contact with hot water*, and thoroughly stirred, THROUGH *a heated bath of mercury*, bringing thereby *the water* as well as *every particle of ore* into *close contact with the mercury.* We *use no copper plates*, and have our apparatus so arranged that *the mercury that carries the gold flows by its own weight* into a retort, where, by a simple vacuum arrangement, *the mercury is distilled back again* from whence it came, and the *gold and silver are left in the retort.* This is all done *automatically*, and *without additional cost.* One machine, capable of treating 10 *tons of ore per day*, with only one man (at a cost of 50 cents per ton), can be constructed *for* $1,000. A *portable machine*, connected with a five horse-power engine, with a capacity to work 10 tons of *tailings* per day, can be made *for* $2,000.

3. The NEW *quartz-dissolving process* differs from all others in *several distinct features:* (*a*) *We use neither soda nor potassa.* (*b*) We do *not only liquidize* the *quartz in water*, but *decompose chemically the silica as well as silicates*, and thereby liberate not only the *free gold, but get also that which in many ores is chemically combined* and locked up in the refractory matrix. (*c*) The *refuse*, the *liquid*, from which, by passing it through my amalgamator, "we first abstract all the gold," *is not thrown away, but utilized* by *Mr. Hardinge* in *various ways.* *One ton of quartz* yields *about* 900 *gallons* of a *hydrate of silica*, which when mixed properly with other tons of pulverized silica and the right quantity of crystallizing agencies, forms with them a *cheap* and *fire-proof porcelain paint*, and supersedes the

* Let it be also remembered that my recently improved Pestle-Mill, combining every advantageous power—viz., a circular inclined plane and pullies—strikes eight hundred blows per minute, will do three times the work of any other, and delivers the pulverized ore in the center, like a flouring mill.

I must here enter my disclaimer against all iron or steel mills. So long as quartz will grind a cast-steel ax, so long will quartz grind chilled iron or cast-steel quartz mills.—*Hardinge.*

further use of linseed oil or white lead or spirits of turpentine. This alone, *without mentioning* the adaptability of this liquid for the manufacture of *ornamental flint marble*, by casting the liquid, mixed with sand and proper crystallizing agents, *into molds* like plaster of Paris, gives to the *hydrate of silica* a value of at least $1 *per gallon.* The *profit* derived from the sale of this article is *by far greater* than *the cost of treating the quartz*, and if we take into consideration the facility with which select quartz can be shipped to *Boston* and *New York* from *Nova Scotia* and the *Atlantic coast* and Central America, and the demand for *fire*, *water*, and *rot-proof paint* and MOULDED *stones*, *statuary*, *fountains*, *floors*, *roofs*, *pavements*, etc., we cannot but feel confident of the success of this our enterprise.

4. The treatment of pure silica by the last-named *sulphide of silicium process*, for the purpose of obtaining a *pure quartz solution*, a *hydrate of silica without alkali* (the water supplanting the base), has still another and very valuable advantage, for by it *all the sulphur* that is *ejected* by the *desulphurization* of the *sulphurets* is therein *utilized.*

From this very condensed statement, it can be seen that these combined processes show:

1. *Great economy*, because nothing is lost; all the refuse is made valuable.

2. *Great saving of time and labor.*

3. *Effectiveness and increased yield of precious metals over and above other processes*, because, as the silica that holds the gold either in fine diffusion or chemical combination is in this process *completely decomposed*, ALL THE *gold can be extracted.*

4. AN UNPRECEDENTED PROFIT. The utilization of the hydrated silica, as well as of all the oxyds, vapors, etc., can clear a large profit, and reduce the expense of extracting the gold from *a ton of ore* (which will cost about $10 a ton) ACTUALLY TO NOTHING; for the *sale* of

the liquid from the working of *one ton* of ore can scarcely bring less THAN $900! *What business, we ask, can exhibit such revenue?*

I am now making arrangements for bringing rich gold-bearing quartz from Nicaragua, Central America, to New York, and also from Nova Scotia to Boston. My object is, first, to dissolve the quartz, and secure all the gold; secondly, to make hundreds of thousands of gallons of the only article of liquor of flint fit to use as a base for the purposes aforesaid, and hereafter perfectly described. And in order to give a clear and correct understanding of what I mean, I will first announce in this department that it is known to very many that whole cargoes of white sand (or in scientific language, *granular quartz* or *pure silica*) are being weekly brought down the Hudson River to New York city and Brooklyn, for making flint glass; and that inexhaustible banks of this sand, pure snow white silica, have been recently found in various places and at different points in the United States, handy to easy transportation by navigation; and because of competition in seeking a market, I am offered this beautiful, pure granular quartz, as white as the purest snow, for a small price per ton.

Now be it known and well remembered that, by the working of the patents hereinbefore mentioned, I dissolve *one ton at a time*, either of this said granular quartz, or of the crushed gold-bearing white quartz of Central America or from Nova Scotia: Every ton of quartz thus dissolved in water, through this new process, viz., by sulphide of carbon first forming sulphide of silicium, thence into liquor flint; the quartz rock held in perfect solution in water at very little cost. Nine hundred gallons of this said *liquor siliccii* will weigh about five tons. These five tons of liquor of flint, together with other crystallizing agents, form the base to mix with several other tons of the crude snow-white sand above described, and cast into moulds without heat or pressure, in the same manner as gypsum is cast in

moulds. And notwithstanding it is the crude white sand which constitutes the major part of the entire white flint statue, obelisk, bust, cornice, bracket, architrave, lintel, mantel, or the thousands of things thus cast in moulds, the surface will always correspond with the mould. If the mould be as smooth as glass, the casting will be the same. If, on the contrary, a colossal statue is to be cast, the mould will be made to correspond with the *pitted* surface of same as in the chiseled statue of colossal size. But in all cases the liquor of flint base (together with its crystallizing agent) fills all interstices, and hence, I repeat, that the surface is as smooth as the mold can be made of any ordinary material. The castings are all in the *cold, wet way*, and *without pressure.* Flat surface castings find their own polish level, as smooth as a looking glass, and when hardened, cannot be scratched with emery. All obelisks, or allegorical sacred devices, with their respective pedestals and entablatures, plain or in *basso-relievo*, to be introduced into cemeteries, impervious to all weather for centuries. Whereas our Vermont statuary marble, being a soft carbonate of lime, begins to decompose in three years.

Pure silica, first held in solution in water, by the processes hereinbefore described, and then prepared with the necessary crystallizing agencies, will, in obedience to its first law of crystallization, form a base which fastens upon the granular silex (or sand), taking up the exact amount of water of crystallization belonging to the original formation of quartz rock described in my chapter upon "The Original Formation of Rocks," &c., and it is just at the moment when the process of crystallization begins that the batch is turned into the molds. I will here remark that while the laws of the crystallization of quartz are the same, yet the action varies as to the time, in accordance with combinations, &c. The reader of this prospectus is referred to the proofs submitted at my lectures some years ago upon

the original formation of the rocks, proving that four-fifths of the rocky portions of our globe were of quartzose formation; and of *aqueous* and not *igneous* origin.

It has cost the writer of this prospectus eighteen years of ardent study, together with thousands of experiments in so concentrating the processes that they will develop combinations of quartz, flint, or silica, in floral organisms, as well as rocks. The last five years of dense thought, untiring zeal, and unceasing labor, have resulted in the production of moulded tables of snow-white flint marble; into which are simultaneously cast liquid mineral oxyds of such chosen colors as will so arrange themselves through and through the white table bed (while it is also in a liquid state); that the colors, being also taken up by the same crystalline vehicle, spontaneously form in vines and flowers in the most natural directions, and alternate forms and entwinations, without my guidance or interference; occupying not over fifteen minutes in forming a slab or table of any shape. All of which become a homogeneous flint, which appears to have been quarried out of a fossilized flower garden; retaining all their bright colors and neutral tints with buds and green leaves; not only upon the surface but the same natural phenomena pervade through the entire slab, or urn, or bathing-tub, or anything else designed for palatial grandeur.

Tables of malachite are as quickly and cheaply formed as anything else, with the trifling exception of the green mineral oxyds forming the coloring. See the difference in the cost of these with the Russian malachite. See a very small stand-top of the latter at the far-famed store of Messrs. Ball, Black & Co., "price $400 in gold."

Now, it will have been discovered by the intelligent reader, that we mold our rocks, from their *original elements*, into synthetical solids in any form we desire; and when they are taken from the molds they are as smooth as glass, providing the mold is smooth; notwithstanding the main body of the material is the crude white sand.

It is the crystallizing agent in the liquor of flint which completes the solid in the interstices, and hence the smoothness of the surface.

If these statements are true, then we think the importation from Italy of statuary marble, at such high prices in the rough blocks, and the everlasting sawing, chiseling, pecking, grinding, and finishing, for months together, and sometimes for a year or more, upon one design, will shortly be superseded, and the great number of marble-yards now in the United States will have been reduced to a dozen works, which can supply the entire demand at one quarter the price, and a better and more durable *snow-white silicious marble*, saying nothing of the unrivaled beauty in tables, etc., before described.

And now, with reference to casting the onyx, the sardonyx, the cameo, and others, in medallion, or other divisions, with the white in basso-relievo, either small or large, colossal when set in entablature in the finish of grand monuments or palatial buildings. These are cast as readily as though all were one color, by merely inverting the mold, and cast the white relief in a medallion head, or other ornamental projection ; then turn in the next color, and when your design is turned out of the mould, your joint is as perfect as a liquid level can make it ; and this is the way the original were deposited in lamina, but not in molds ; and hence the great trouble of the lapidary to give us the design in bas-relief.

Having submitted a comprehensive *exposé* of the most weighty department of my intended business, so far as avoirdupois is concerned, it comes within my province to now explain an inconceivable additional claim upon us, as soon as our works shall have been put into operation. Our said liquor of flint, when mixed with the suitable material to form cold porcelain, and this spread upon walls, will immediately harden into a perfectly white porcelain, and will resist everything that porcelain resists. When colors are required in neutral shades, the right kind of mineral oxyds will be kept by us, with

directions to the painter. The Italian and other fresco painters will be supplied also.

The painters and grainers will be supplied with the suitable semi-transparent oxyds which work with our liquor of flint, such as burnt terra de sienna and terra de cassel for mahogany, and unburnt umber for oak, same for maple, satinwood, etc.* All houses will be fire-proof throughout. And when we remember the cheapness of our material, we must predict the immediate end to the demand for white lead or zinc white, linseed oil, spirits of turpentine, copal varnish, etc.

We shall furnish a suitable cold porcelain to be cast one inch thick upon floors, with instructive designs for either mosaic or carpet-like colors. Also, for roofs, white, with the coarser white sand sprinkled upon them; they will resemble snow-crust in appearance; are also fire-proof, and the best non-conductor; will also have a tendency to keep the chambers cool.

In conclusion, I am bold to announce that when men shall learn to build and carry out the determination with reference to the fire-proof finish, we shall cease to read the almost daily reports of the losses of millions of dollars by fire.

In my recent visit to Boston, where I was invited to lecture upon the "Original Formation of the Rocks," and the progressive developments of floral and animal organisms; through what laws and agencies the sixty-five elements of matter were generated, throughout the six divisions of time, up to the Adamic period, etc., and having been cordially invited before several of the halls of science in our modern Athens, it may be well to submit some of the evidences of approbation there.

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* Grainers will be instructed in the production of an artificial *stone veneer* upon doors, &c., in variegations, representing the "*knarled oak*" (*Pollard oak*). No blaze of fire will have any effect upon those porcelain veneers. They are also impervious to the weather or friction; hence, very durable.

REPORT OF A COMMITTEE APPOINTED BY THE LEGISLATURE OF MASSACHUSETTS.

The following is a synopsis of the evidence submitted to the undernamed in their official investigations into the merits, value, and promise of extent of revenue to the State of Massachusetts, should the charter be granted to incorporate the "Boston White Flint-Marble Company," under proper restrictions, and under the supervision of Messrs. Hardinge, Fleury, and their associates.

"Mr. Hardinge appeared in person before us, and minutely explained the results of long years of experiments in his peculiarly manufactured liquid quartz, or liquor of flint, as it is generally termed, some of which he presented before us as clear as water. *He turned out some of this liquid flint, and before our eyes formed it into a semi-solid, and from thence into a solid semi-transparent stone, resembling opal.*

"*He then produced specimens of white stone which were evidently cast in moulds.*

"He then showed us plain pieces which had been cut into shape with a knife when in a soft state, but which would ring when struck, and appeared flint-like in hardness.

"He then showed us others which were colored. To the reality of which, Prof. CLARK, of Amherst College, and member of the Massachusetts Legislature, in his own person before us declared, not only that he had proven that the material presented to us was what it claimed to be, but that it demanded our approbation, and the official attention of the Legislature.

"Other persons of high standing and respectability, have been before us in relation to this subject, and we have therefore reported accordingly, and hope and trust that the proper charter will be granted."

The committee appointed by the Senate and House of Representatives consisted of Hon. Messrs. POND and CHASE, of the Senate, and Messrs. POLLARD, PATCH, WOSON, NEEDHAM, and STAAT, of the House of Representatives. I subsequently received the following letter:

"BOSTON, May 1, 1867.

"PROF. B. HARDINGE:

"*Dear Sir*,—It affords me great pleasure to testify to the value of the discovery you have made, of a process for dissolving silica, and using the solution as a cement for uniting particles of sand, gravel, and even small stones, into a firm and durable mass, which may not improperly be called "flint marble." This marble, if made of white Berkshire sand, may be as beautiful as the purest Italian statuary, and yet remain entirely unaffected by exposure to our severe New England climate.

"But by marvellous ingenuity you have devised means for imparting to this spotless stone any desired tint of color, which may be either diffused equally throughout the mass, or distributed in bands and veins.

"The value of the 'flint marble' consists, however, largely in its capability of being cast in moulds, precisely like gypsum.

"The figures thus formed take the polish of the mould, and possess the hardness of flint and agate.

"I am confident that, under suitable management, a very profitable and extensive business might be built up upon the basis of your discovery.

"With best wishes for your success, I remain, very truly yours,

"W. S. CLARK,

"*Professor of Chemistry in Amherst College.*" *

I will here state, that notwithstanding the stringent law passed by the last session, making it the imperative

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* This gentleman is not only a member of the Massachusetts Legislature, but known to fame for his scientific skill and ability as a chemist.

duty to grant no charter unless it be clearly and unequivocally shown that such charter shall be for a truly practical, profitable, and praiseworthy object; hence the special investigation above alluded to. The following is the title of the charter which has just passed and signed by Governor Bullock:

CHARTER.

COMMONWEALTH OF MASSACHUSETTS.

In the year of our Lord one thousand eight hundred and sixty-seven.

An Act to incorporate "The Boston White Flint Marble Company."

Be it enacted by the Senate and House of Representatives in General Court assembled, and by authority of the same, as follows:

SECTION 1. BENJAMIN HARDINGE, * * * *

[Here follows the charter in "due form"], signed as follows:

In House of Representatives, May 29, 1867, passed to be enacted.

JAMES M. STONE, *Speaker.*

In Senate, May 29, 1867, passed to be enacted.

JOSEPH A. POND, *President.*

MAY 30, 1867.

Approved,

ALEX. H. BULLOCK.

Having thus prepared the way in Boston, for the supply of the New England States, with the view of organizing a company at no distant day, after the business shall have been established in New York (my residence being here), I hereby respectfully submit these (with the following) pages not only to the speculative and curious, but to the careful attention and closest criticism of the learned, the wise, and most intelligent savans of this age of scientific investigation. *See Appendix.*

APPENDIX.

I will now append a few remarks as an EPITOME—a recapitulation of some *original* points of interest to intelligent readers. Albeit, the class of men who are practically engaged in scientific pursuits is small; but, nevertheless, the intelligent masses are waking up to an unprecedented inquiry, not only in relation to their own anomalous compound as a *physically* and *mentally* organized being, but of what materials we are made, and by what laws are kept in motion, and what our world is made of and kept in motion, and when and where trees come from and what they are, and of what every individual thing is combined and how, without the trouble of much study or of much thinking. Unless new things are presented upon vehicles of familiar thoughts and exciting similitudes, in common homiletic language, and (as my scientific friend, Prof. A. L. Fleury, has told you), I have an irresistible propensity to illustrate the most abstruse scientific subject by some amusing anecdote—because my judgment and experience tell me that I sacrifice *dignity* for the benefit of my inquiring neighbor or intelligent friend. Albeit, there are and always have been, and always will be *stony ground hearers*, at all lectures or homiletical sermons. These but eat, drink, sleep and die—to manure a crop of *like transmissions!* But these pages are dedicated to a very large class of progressive intelligences; and aside from my more important objects of presenting the foregoing pages to the public, and more especially to the *dearly* BOUGHT *intelligence* of practical gold-miners and their associated capitalists; also aside from the greater, and by far the

most lucrative as well as the most extensive in prospectu, viz: the moulding into synthetical solids the white flint, &c., &c., described in these pages last aforesaid, thus utilizing the liquor of flint in forming the *base* of the vastly extensive and vastly varied business last described.

Aside from all this, there exists another prompting to all the foregoing explanations, and that consists in the fact that common observation, together with the meagre history of the past relative to the subjects of my long years of ardent investigations, *always* accompanied with thousands of practical experiments; the result of those long years of incessant toil in heretofore unexplored fields, floods and caves of geological mysteries; from which explorations and tested facts I am now able to present a Geological Text Book, for the use of *Schools, Colleges and Academies.* See my Hand-Book upon the "Formation of the Earth," origin of the rocks, trees, plants and animals—the progressive types of the latter, their alternate developments by culture, climate, transmission of qualities, &c,, &c., from the first formation of our globe into a gaseous nebula, thence into a semi-fluid, thence fluid, thence semi-solid, through those first generated elements which generated the laws progressively and simultaneous in their action in the said progressive accumulation and atomic aggregation of matter: And the TIME and times (upon scientific calculations) from the first nebulous formation to the close of the *first* creative "*yome*" or creative division of the "*yomim,*" or six creative divisions (recorded by the inspired Moses in the Hebrew language), together with my own interpretations not only of the number of thousands of years in the aggregate down to our present "*yome*" or final *day* of another deposit of *combustive* agents, which when sufficiently combined with the now immense amount of *latent* spontaneously deposited volcanic agents, now beginning to be heard and felt in certain new localities, and admonish us that they are the certain signal-guns, increasing "*earthquakes in divers places*" prior to the universal roar of God's own artillery! There will be a suffoca-

tion of every breathing animal; who in the last effort to escape affrighted from the nearest volcano, which shall have buried a city, a forest or a village in its resistless vortex, will fall lifeless by the inhalation of carbonic oxyd. See whole explanations, with causes and effects *a priori ad posterius*, with scientific proofs which are minutely presented, and the consequent reasons. *A posteriori ad prius*, for the sure and certain results last aforesaid, fully explained and exemplified in my said coming book above mentioned, which will be found along with this and two other books (from my *exclusive* pen) in every principal book store in New York city, explanatory of all; together with the *time*, &c. Fear not yet, my awakening reader! you and I have *time*, perhaps, to further usefulness in this *little* world of ours before the final consummation just faintly alluded to. I say *little* world, because it is very small in comparison to *Jupiter;* but I find it big enough for my full comprehension—don't you? especially as the time allotted to you and me, and all the rest of us, is too short to fill up any more than a small portion of those progressive susceptibilities which God in his goodness has vouchsafed to man. But there is hope in a *future* progressive sublimity of the liberated soul (when those terrestrial cords are cut), shall soar away on upper spheres, from anxious cares and tears, entering into that unknown transition of new spiritual susceptibilities of sublimer themes than belong to men to attempt to describe, but which we may presume to suppose are also progressive in their approach toward God's own intelligence, as long as "*immortality endures.*"

But excuse me *patient*, or *impatient*, reader, as the case may be. Our occupations while here are terrestrial though varied. It is written that "by the sweat of his face man shall eat his bread;" and every philosopher knows that if he don't sweat by locomotive action, he will not enjoy eating very long. Therefore let us keep to our subject.

Thomas Dilworth, in his elocutionary elements and

lessons in brevity of speech and writing, illustrates not only the *latter* scriptural idea by—

> "Go to the plough or team, the hedge or ditch ;
> Some honest calling use, no matter which :"

but our said very old master, Thomas Dilworth, in his interdicting the too frequent use of the conjunction "and," happened to illustrate by the following sentence: "Nature clothes the *Beasts* with *hair*, the *Birds* with *feathers*, 'and' the *Fishes* with *scales*." Our venerable old master Dilworth's book (in octavo, calf bound, with *all* its contents and copper line engravings), though out of print for the last half century, left valuable as well as lasting impressions.

But Mr. Dilworth did not tell us *how* nature clothed the *beasts* with *hair*, the *birds* with *feathers*, and the *fishes* with *scales*. I presume Mr. Dilworth did not know : and a further evidence that he (or others) did not know, was, that had he known, he could have given us a much longer column of illustrations before it was necessary to write the "*and*" before the last illustrative noun. And as nobody has either carried out the catalogue or told us *how* dame "*Nature*" does those things, I will explain, as far as space will permit, the how, why and wherefore "*sulphide of silicium*" (or "liquor of flint") is both eaten and drank by men and all other animals, and also drank and absorbed by all trees and plants, all the crustacea family from *infusoria* to mammoth bivalves, to build up in laminæ the stone houses of the latter, the framework and table-plated epidermii of the bones and teeth, laminated horns, hair, nails, &c., of animals, the *onyx** that

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* "Onyx" is the Hebrew as well as the Greek word for *horns* and *nails* of animals. The inspired Moses saw in his vision, and wrote of the *new* genera (*mammalia*) of docile, ruminating, horned and hoofed quadrupeds, for man's domestic control as well as food. In contradistinction from the millions of ferocious dragon and crocodilian genera, forty feet in length, as now proven (by their petrified remains) to have existed through the long carbonic period: But all destroyed by the universal volcanic action from which "*A mist went from the earth*," &c. See my lectures upon the "Formation of the Earth."

the inspired Moses alluded to in his *creative* account (see the Hebrew and Greek); also in forming the elongated hexigon-formed fibre of trees, stalks and grass, the supernatant residuum (in obedience to a law in the physiology of *all*), thrown to the surface to be further carbonized, &c., so that the *enamel* thus deposited upon the surface of the Malacca cane of your great grandfather, and the enamel of his teeth and razor-hone and gun-flints, the *vegetable ivory* thimble of your grandmother, are results of the spontaneous existence of "sulphide of silicium." Thus while you now eat "*green* corn," you eat all the *silica* which (had it been left upon the stalk) would have formed the flint coating, like other cereals, as well as their stalks, and of every spear of grass, to produce and reproduce the bony framework and cartilaginous tissues, &c., of animals.

My relation of an illustrative anecdote before the "Massachusetts Historical Society," in answer to a question put to me by the President, Dr. Jackson, will admirably explain our subject. It has never been printed, excepting in the reports of record in the archives of said Institute, in accordance with a resolution passed on said occasion. Albeit, it is not the *printing* of these, or any other facts or theories of mine now coming out before the *great critical world of scientific investigation;* but *facts proven constitute* the motto "*Magna est veritas et prevalebit,*" while all unproved theories only fill up the budget of confused false teachings, which it becomes the duty of every scientific man to empty out, unravel, search, analyze, and present an exposé of reasoning upon defiatory scientific arguments. But to our "anecdote," which, in short, illustrates *four* or *five* important scientific points, *then*, as well as *now* in *question:*

It was in 1854 that a selected specimen of gold-bearing quartz was presented before the dilated eyes of *eighteen* enterprising young New Englanders, who, tempted by the most *seductive* of all attractions, left their *wives* and sweethearts *en route* overland *via* the "*South*

Pass," Rocky Mountains, where, their weary limbs to rest, (*bivouaced* for the night under a projecting ledge, during a thunder-storm,) * * * *

> By westward current stream,
> Through dreary night by hunger press'd,
> "And 'Salem' was the mournful theme"

of him, the chosen pilot; while three hardy ship-builders from Barnstable were dreaming of doubling Cape Horn in a gale of wind, with the extinguishing light of hope glimmering upon a far, distant promontory; another dreams of *ballasting* a ship with gold-bearing quartz; while one from Boston dreamed of breaking his (Maine-law) pledge in the rain, up a dark alley in Winter Street; another from Lynn, dreamed of steam-tanned calf-skin, split-leather and wet feet; another of a choir-service and the loud peal of the organ preparatory to starting the "judgment-anthem," when the lightning struck the steeple-rod and passed fluid into the ground and water all around him; another from Chicodee Factory, dreaming of his (*imitation*) Scotch gingham,* and why the rain brought down upon his hands the black sulphate of iron, besmearing the *remains* of his coarse, tattered, and button-less bob-tailed gray (all of which he had bought on the expensive side of expensive Broadway). At daylight the storm was over and gone, and some dreamed of coming thanksgiving and quiet doxologies, others of retreating *deer* across the interminable La Platte; when they

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* Can anybody tell why we must send our cotton to Manchester (England) or to Glasgow, or anywhere else across the Atlantic, to have it dyed in fast colors for our umbrellas? While England, France, and Germany give us of their richest textile fabrics in cotton, silk and linen, they impose upon us in woolen beyond ordinary power of conception. They spin their coarsest wool into a fine thread; it makes an apparently fine flannel; it is well dyed; the nap is raised with teazles; an oil finish makes it look like what it is marked with white silk letters, "*superfine*," and invoiced *low for the American market.* So much for our "BROADCLOTH" that wears out in three months!

were suddenly aroused by the flapping wings of a large flock of wild turkeys from a stream (containing gold-bearing quartz pebbles) into the top of a tree directly over their heads. The gastric juices prompted the order of effects from their rifles, and down fell two of their surprised visitors. "Let us see what they eat," said Hancock Beals, as he turned out the crop. "Yes," said Quincy Adams Lapham. "Oh! *fire, love and hominy*, here's gold specks in all *them* gravel-stones!" as he exhibited an ovoid pebble an inch long and as large at one end as the little finger. "So there *is* in mine; look at 'em all! By hokey we'll carry them as a curiosity." And they did bring them home. But that "curiosity," that very suggestive "Ureka"! That most marked though accidental index to the inquiry, viz: what did the rest of that flock of wild turkeys do with all the gold-bearing quartz-pebbles so quickly picked up by them? *Spirit of old Master Dilworth!* of the last century's teachings,—that "nature clothes the birds with *feathers*,"—if you had but said clothed with "sulphide of silicium," or liquor of flint, and told us all about the facts that, albeit, the *birds* all have *quartz mills*, they use them to grind oats, corn, &c., while they dissolve the quartzose *gravel* and *pebbles* in their *digester*, containing the generating agents of sulphide of carbon, phosphate of lime, and other spontaneous solvent agents, assisted by status electricity. Every particle of the quartz is held in perfect solution, and deposited in a succession of thin laminæ upon the feathers. Birds do not urinate. The gold specks are voided in and amongst the smooth *fæces*, unaffected by any of the solvents aforesaid.

The supernatant sulphur is separated (by the organs of the female bird, as seen in the *yolk* of the egg), and ensconsed within a *non-conducting* membrane, which retains the other generated elements of vitality* indispensable to generating the chicken, while the common

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* See my chapter upon the generating elements of life and vital power.

shell (outside the said ovara, or silicious non-conductor) is a weak carbo-albuminate and sulphide of lime, &c., that it may partially decompose to give easy egress to the chicken.

The reasons become obvious why the she-bird's feathers are of coarser laminæ, and not variegated like the male. But the gold-separating lesson constitutes the important particular upon the main subject of *this* pamphlet.

My way of lecturing upon these (as well as all other) subjects, differs from those pursued by the schools. My only apology for it is, because it's *my* way. If I am asked the component parts of yonder tree, I should answer that it is nearly half and half of oxygen and carbon; that it represents, in itself, a country grocery store—for, aside from yokes, rakes, and axe-handles, it contains soap, starch, vinegar, sugar, writing-paper, writing-ink, bath-brick, fire-wood and charcoal, as you please to use it. If I am asked where it came from, I could demonstrate thus: Take an old iron tank that will hold a cart-load of gravel and aluminous soil; bake and weigh the soil; put the baked dirt into the tank which you shall have perforated, that it have plenty of water percolating into and out of the tank; set it exposed to sun and rain; plant an acorn, and when you shall have raised a tree weighing 200 or 500 pounds, take it out, shake off all the dirt from its roots; bake and weigh the dirt again;—you have lost no dirt. *Question:* Where did this tree come from? *Answer:* The atmosphere, the rocks, and the other elements described in my publications; and why "the tall Tannan grows loftiest on loftiest and least sheltered rocks," where there is but the least perceivable support of earth for roots among the fissures of the rocks. Where did the sixty-five elements of matter come from? *Answer:* Read my *four* pamphlets. You will find there newly discovered facts worth knowing.

Again I (like Doctor Abernethy) invite all to read my books.

BENJAMIN HARDINGE,

20 *Waverly Place, near Broadway, N. Y.*